RAPID-VAC

HALVING THE FORECAST TIMES FOR VACCINATING THE UK

USING INDUSTRY TECHNIQUES TO INCREASE CAPACITY, MAXIMISE RESOURCES AND REDUCE BURDEN TO DELIVER A FAST TRACK MASS VACCINATION PROGRAMME WITH ACCELERATED POPULATION IMMUNITY.

FOREWARD

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HEALTHCARE TRANSFORMATION EXPERTS

A vaccination programme that will accelerate the roll-out across the UK to get the population protected and beat the pandemic is drastically needed.

With clinicians soon to become the limiting factor, it is vital that we are able to maximise 'needle to skin' time, with vaccinators having the highest level of 'value added' time possible.

In this paper, we detail how using industry techniques with one hospital trust, we were able to increase the vaccinations per staff member by 153% improving injection numbers from 15.2 to 38.4 per staff member, whilst maintaining safety protocols and a positive patient experience.

This model, described as Rapid-Vac, is currently in operation with the opportunity to be quickly and easily rolled out to further vaccination sites across the UK from village halls, to GPs, to community centres, to mass vaccination centres.

Skilled and trained resources to administer the injection in a safe and proper way for patients will become the major constraint.

INTRODUCTION

The NHS is facing its toughest challenge since its creation - we have never needed or relied on the NHS as much as we do right now. Resources, capacity and space is being tested to the limit through the COVID-19 pandemic as it spreads and creates havoc in our communities and, in fact, across the globe.

The UK has been at the forefront of approving international vaccinations for rapid deployment and the biggest immunisation programme we have ever seen. The current model is good, but will not scale at the rate required to get mass vaccinations and a significant proportion of the population with enough immunity to see off this terrible virus.

The volume of vaccinations required and the time taken to complete the mass vaccination programme does not currently align with expectations in terms of pace and volume and the demand far outweighs the capacity currently.

Vaccine production is not going to be the limiting factor - skilled and trained resources to administer the injection in a safe and proper way for patients is the major constraint.

The current model defines clinical input which is the limiting factor to be able to scale and increase patient numbers to the volume required.

With this is in mind we have taken industry thinking and applied it to the current NHS model for local vaccination centres to enhance the model and to create greater capacity with fewer resources required. By taking a well-established concept known as Lean and tools such as QCO (Quick Change Over) we can quickly, easily and simply increase capacities across the UK.

So, what problem are we solving with an improved vaccination centre model?

The UK Government and the NHS has set out a time and ambitious but critically important timetable for the vaccination of the UK population against Covid-19. The level of vaccinations required to complete this program will require every resource available to be used effectively and efficiently if the program is to succeed.

The current NHS model for mass vaccination has limitations:

- The current national model for community and mass vaccination sites is slow and resource heavy.

- The target for the existing NHS vaccination model was 520 vaccinations per day, reduced to 312 as the model was subjected to PSD and additional pharmacy constraints, and has proved to be sensitive to changes in the clinical and pharmacy models required by different vaccination protocols (eg Pfizer emergency licensing pharmacy requirements and PSD/PGD).

- The footprint for these 'PODs' is large and they require high and unnecessary levels of clinical staffing.

If we are to achieve the ambitious, but necessary rapid vaccination of the population to beat Covid-19, we cannot afford to continue with the current model in the way described. It will take too long to vaccinate the population to the right levels. We therefore have to enhance and adapt the current model.

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what if we could vaccinate the whole population in less than 6 months?

AN ENHANCED MODEL FOR MASS VACCINATION:

What if we could vaccinate the whole population in less than 6 months?

This might sound like a pipedream, but with the right model, right resources and some good coordination and planning, this is feasible and could be achieved. In order to achieve this, we need to enhance the current model and create more capacity with the same or less resources.

A proven and ready to roll-out enhanced model:
The 'Rapid-Vac' model we have developed in partnership with a West Midlands CCG is capable of **almost doubling the *vaccinations per day of the existing model and doubling the number of vaccinations per staff member involved.***

It safely raises the number of vaccinations a 'POD' can do to 960/day and increases the vaccinations per staff member from 15.2 to 38.7/day.

It is not sensitive to required changes in clinical or pharmacy models which, as might be the case in both models, may require additional staffing.

These changes will not slow down the Rapid-Vac vaccination process at all. Furthermore, the existing model is resource intensive for skilled/qualified staff (who are under pressure to manage pressure in other parts of the NHS). The Rapid-Vac model addresses this with improved skill mix, reducing the number of qualified nurses required in the model whilst retaining clinical oversight and safety for all patients.

Practical application of the model

Using this approach - working in partnership with a West Midlands CCG and Acute Hospital - we have designed and implemented the model and, to date, we have achieved the following:

- Created a modular design for a large scale vaccination centre capable of delivering 960 vaccinations a day
- Deployed this model in an Acute Hospital setting (hospital hub) and, as at noon 09/01/21, delivered 12,739 vaccinations to Healthcare staff in the STP footprint and patients from the acute.
- Consistently delivered 60 plus vaccinations/hr,7 days per week (regularly exceeding 70/hr)
- Mobilised the model in two leisure centres which are both now capable of delivering 960 vaccinations per day (current constraint on this is vaccine supply and sufficient JCVI priority patients.)

RAPID-VAC
RAPID VACCINATION MODEL

- Secured resource and premises which, with adequate vaccine supply, could deliver a 1st vaccination the whole adult population of the Local Authority (186,000) in less than five weeks.

LEAN IN HEALTHCARE

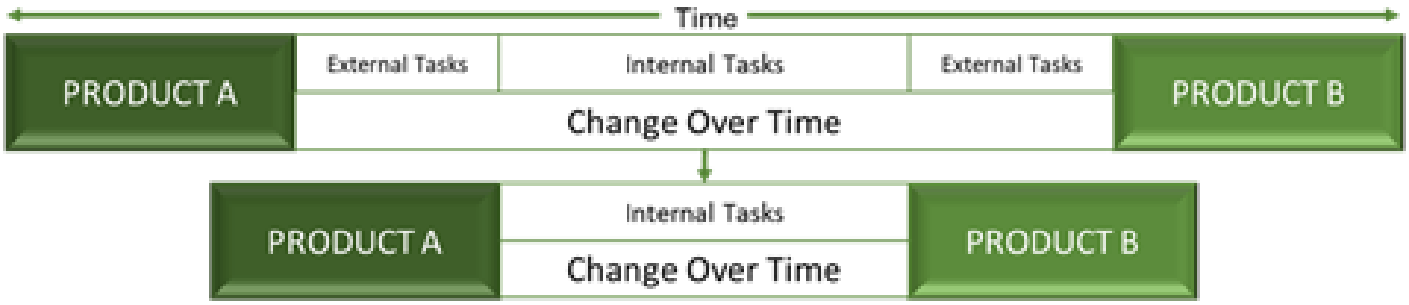
Lean is a well-established methodology used extensively and more recently (last 10-15 years) in healthcare across the globe and within the NHS.

Lean is a concept and set of guiding principles and tools to help simplify operations and to allow management to easily see the clear status and react in real time to make adjustments to achieve the output or goal.

Our high level approach to this is to identify and maximise the utilisation (uptime) of our most critical machines, ensuring they run as fast as they can, for as long as they can creating the right outputs every time.

We measure customer and internal delivery as On Time- In Full (OTIF) in industry and equipment uptime or lost time as measures also. In industry we typically target >85% equipment uptime with best in class companies such as Toyota targeting a >97% uptime. Best in class manufacturers target and consistently achieve >95%+ OTIF by creating and adjusting processes to deliver what the customer wants and when the customer wants or needs the product, service or outcome.

Quick Change Over (QCO) is a method of reviewing, analysing work content and the process for changing between machine operations by separating internal and external work to keep the machine running for longer by reducing stops.



A good example of this is a Formula 1 pitstop. The process has been analysed, practiced and optimised constantly before and during the season.

The team all have clear roles and responsibilities, the process is documented, standardised and the process optimised to execute the shortest time possible for the car and driver to be stopped.

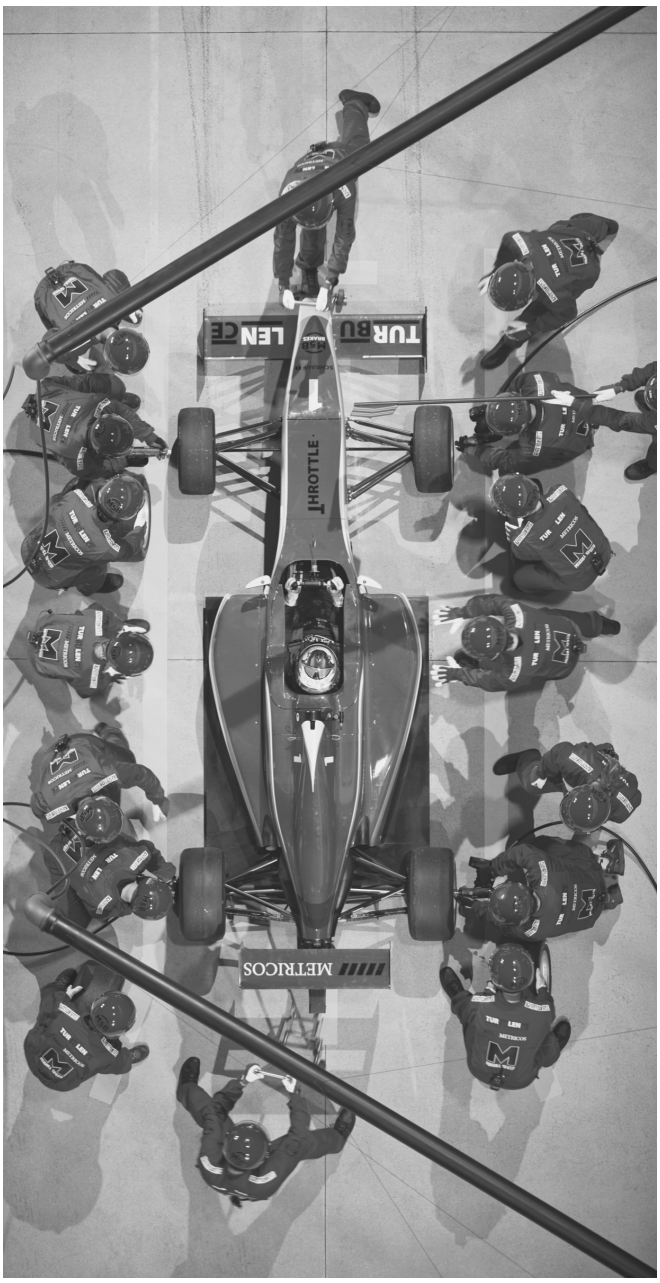
All materials and preparation is brought to the car ready for the stop. The result is the car stops for only a few short seconds each pitstop.

If we apply this logic in the NHS we want the patient to replace the driver and car and apply the same logic.

All preparation should be complete before the intervention and we want to minimise the waiting time and time the patient is waiting for the process (external work).

This approach has been successfully applied to outpatient clinics, MRI scanning, diagnostic services and even theatres.

This logic directly applies to vaccinations. We need to separate the preparation for each patient with the actual procedure



of the vaccination. This allows us to reduce the time for the clinical specialist, but still manage the patient through the journey with empathy, dignity and at a reasonable pace.

WHY IS RAPID VAC SO MUCH FASTER?

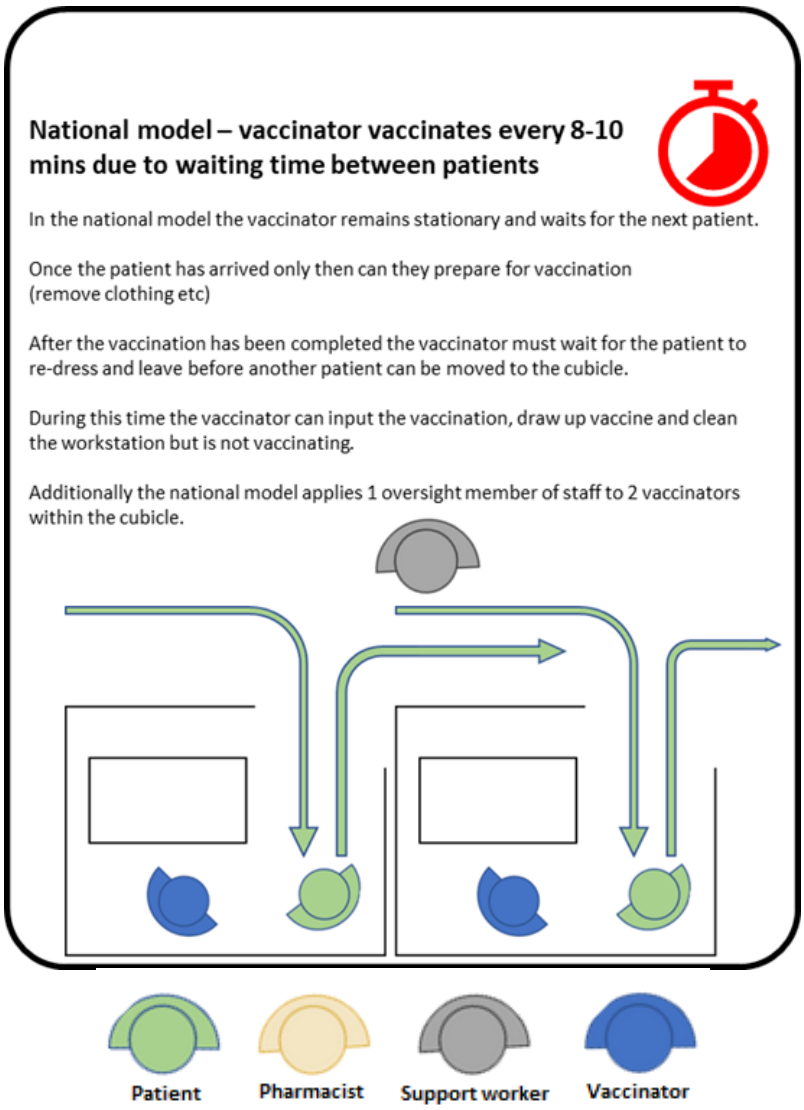
The current NHS vaccination 'POD' model has been deployed and allows local heath communities to set up and get started with mass vaccinations centres across the UK. This model was loosely based on an outpatient/GP appointment approach with the vaccinator receiving, administering and vaccinating a patient whilst remaining in a cubicle.

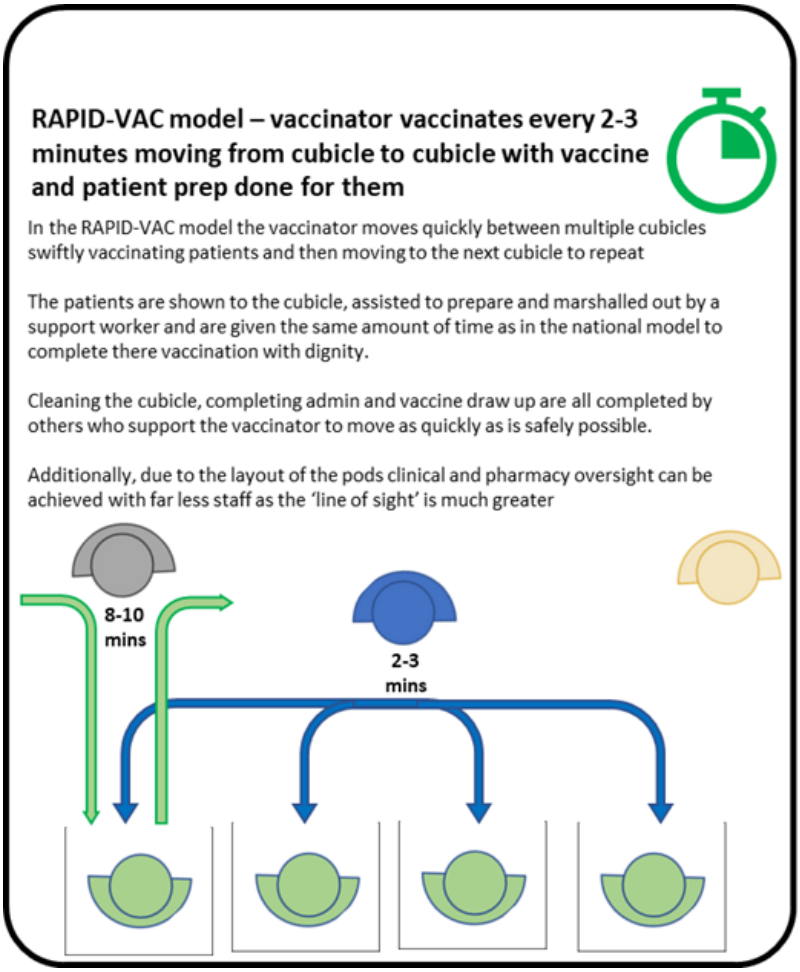
By applying Lean thinking we have identified that the vaccinator spends upto one quarter of their time not vaccinating. Whilst the vaccinators are undertaking other tasks in this time these are at the expense of vaccinating more patients.

As with the industry example if we prioritise and optimise the vaccinator role we can double the number of injections and further improve from this baseline.

This is done by removing the additional tasks from the role of the vaccinator and handing them off to other resource we can easily increase the number of vaccinations a vaccinator can complete by as much as 400% overall.

A further point to mention is that this is not about working harder, but working smarter and in a safe way for staff and patients.





If we take the current model and apply a Lean lens, we can begin to see areas of the existing process where inefficiency exists. Ultimately, if resources can be reduced or number of vaccinations can be increased by removing wasteful activity (or in-activity) we can either do more with the same or the same with less.

The Lean lens immediately allows us to identify tools which could be used to remove waiting time, reduce the number of skilled individuals required to run the process without impacting the quality, safety and patient experience of the vaccination process.

Vaccinators

The most valuable resources in the process are the vaccinators who are the rate-limiting resource in the model. Faster vaccination equals more people vaccinated/ vaccinator.

The existing model is broadly based on a typical outpatient or GP practice where the clinician remains in the cubical and watches the patient move in and out of the cubicle. This introduces waiting time for the clinician whilst the patient settles and prepares for the vaccination.

Vaccination time is being lost if the vaccinator is spending significant amounts of time waiting for the next patient to arrive and be prepared for vaccination and then waiting once more as the patient is administered and leaves and the cubical is cleaned for them to receive the next patient.

Critical to maximising the ability of the vaccinator to vaccinate at speed is allowing them to move from patient to patient as quickly but safely as possible. To achieve this without impacting the patient experience, we have designed a process which allows the patient to move into and out of the cubical in approximately 8 to 10 minutes whilst the vaccinator moves swiftly from cubicle to cubicle on average within 3 minutes.

The model of matching elements of the overall process which have different 'cycle times' to prevent waiting is a longstanding and widely utilised fundamental of manufacturing.

Nurses

In other areas of the existing model, we can see highly skilled nursing staff (B5) administering the health check document during the health check process.

By applying the Lean lens, we can see that the most critical element of this process - the clinical assessment of those who need it - can be made external to the process of collecting the information required to make that clinical decision.

In our model, the patient either completes an NHS approved pre-screening and consenting document at home prior to presenting or in an assessment area prior to vaccination with support from volunteers. Should the process identify any patients who have answered the questions in a way which requires a clinical assessment of the patient's suitability to be vaccinated, they are referred to a nurse who can make a clinical assessment of suitability for those who need it. In our trials, we have seen that this assessment is only required for approximately one in 10 of patients presenting for vaccination.

This improvement removes four highly skilled and highly-qualified nursing staff who in the existing model are all completing paperwork prior to clinical assessment, to be redeployed and utilised in other vaccination centres or critically returned to the frontline to manage other critical NHS pressures during the winter. Furthermore, as this process is carried out prior to vaccination no time is wasted in the vaccination pods with patients who are unsuitable, ultimately reducing the risk of inappropriate vaccination.

Administration and Pastoral Care

Throughout the process, we have identified tasks which are unnecessarily being completed by highly skilled (and scarce) resources. The model identifies those tasks which can be completed by different staff to improve the availability of scarce resource (vaccinators and nurses, etc.) and utilise other more available resources (HCA/Volunteers) to complete appropriate tasks and tasks not directly contributing to the physical vaccination.

As we analyse and then trial and prove new ways of working in industry, we have taken the same approach with the first vaccination clinics and locations. By analysing work content, patient flow, delays, and the content of work at each stage we can quickly assess how to improve and increase the number of vaccinations per staff member per hour.
This is not about working faster, this is about optimising the process and working 'smarter not harder' to achieve better outcomes and capacity.

As with any pathway redesign we support in the NHS, we engage staff, patients and carers to ensure we get a wide view to ensure what we agree to change has a positive impact, is sustainable and repeatable for any centre or location being set up to support the COVID-19 response.

ENHANCED 'RAPID-VAC' COMMUNITY & MASS VACCINATION MODEL:

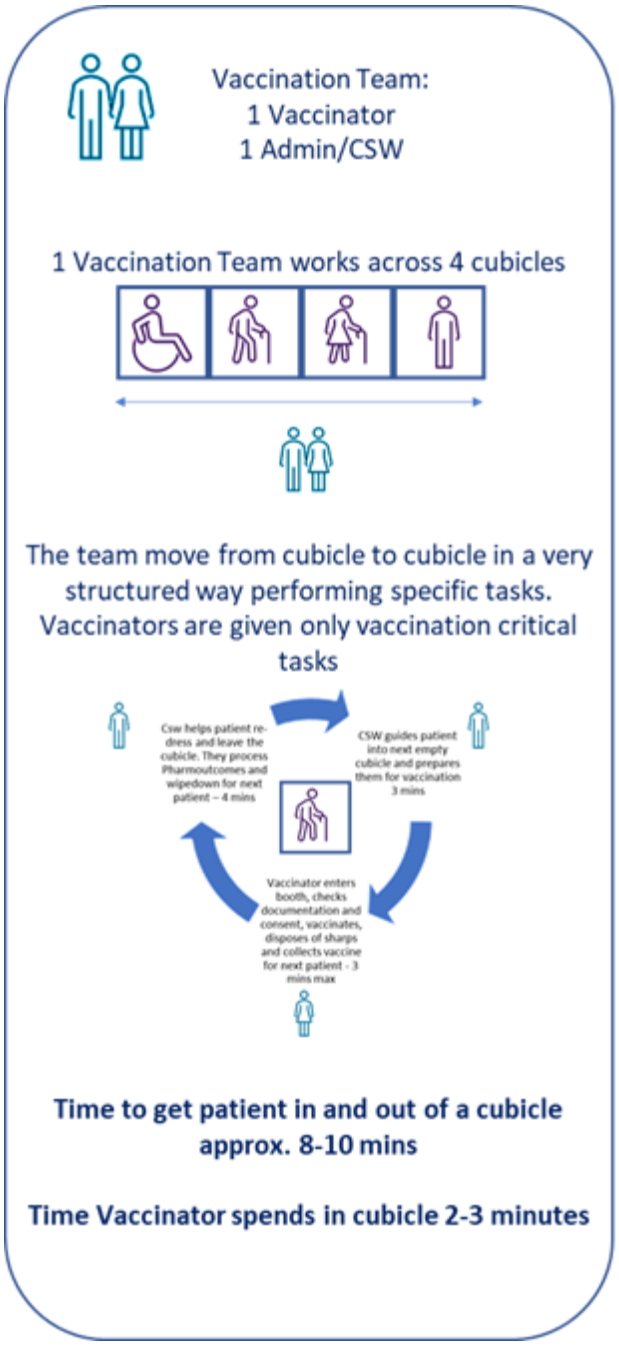
Using a Lean approach to designing the vaccination process forces us to analyse the current model, think of ways to improve and then engage with staff to trial different improvements in a controlled and time bound way to prove or disprove any benefits.

The way we have applied this to a process such as mass vaccination is by splitting the activities into critical activity and non-critical activity. Our constraint and bottleneck area will be certified and qualified clinical staff to carry out the injection and administer the right drug to the right patient at the right place and time. We therefore need to focus on all activities that don't contribute to this activity and split them out as we would in quick changeover and designing manufacturing cells in industry.

By splitting the activities required to vaccinate a patient into critical activity and non-critical activity, we can identify times in the existing process where our most valuable resource - the vaccinator - is not carrying out the most critical part of the process - vaccinating!

Elements of the patient experience which are critical are, in the existing model, completed whilst the vaccinator sits and waits, wasting the time of our most valuable resource.

By making all non-vaccination elements of the process external to the vaccination process itself (needle in, adminster vaccine



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RAPID VACCINATION MODEL

rom syringe, needle out) we can vastly improve the utilisation of vaccinators and, as a result, improve vaccination throughput by 100%.

To externalise the other elements of the patient journey, we require each vaccinator to work in multiple booths and for them to be supported by an Admin/CSW however this team member is fully utilised completing other essential activities.

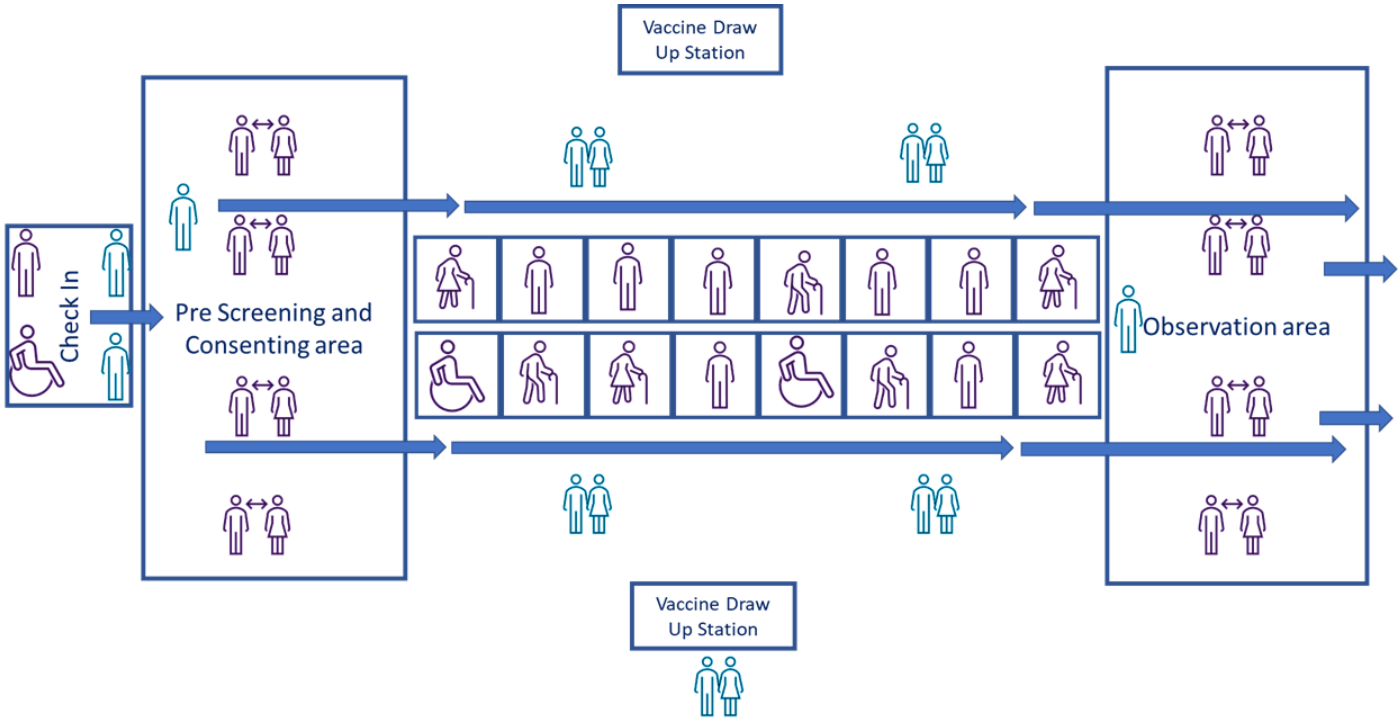
Our Rapid-Vac model is capable of **960 vaccinations per day and more than doubles the number of vaccinations** per staff member involved.

It is not sensitive to required changes in clinical or pharmacy models which, as might be the case in both models, may require additional staffing. These changes will not slow down the Rapid-Vac vaccination process at all.

Additionally, the existing model is resource intensive for skilled/qualified staff (who are under pressure to manage pressure in other parts of the NHS).

The model is easy to adopt, simple in design and has all roles, processes and procedures created to be almost a 'boxed' solution for small or large centres. We have called the 'offer' Rapid-Vac to describe what the outcome is once implemented.

EXAMPLE LAYOUT OF A RAPID-VAC CENTRE – 960 PATIENT CAPACITY (12HRS)



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STAFFING COMPARISON

Whilst the Rapid-Vac model uses slightly more staff overall it can vaccinate 960 patients in a 12 hr shift vs 520/320 so the staff/vaccination ratio is much higher. Additionally, the Rapid-Vac model uses less B5 Nurses which potentially releases them back to front line working.

Rapid-Vac vs PSD Model

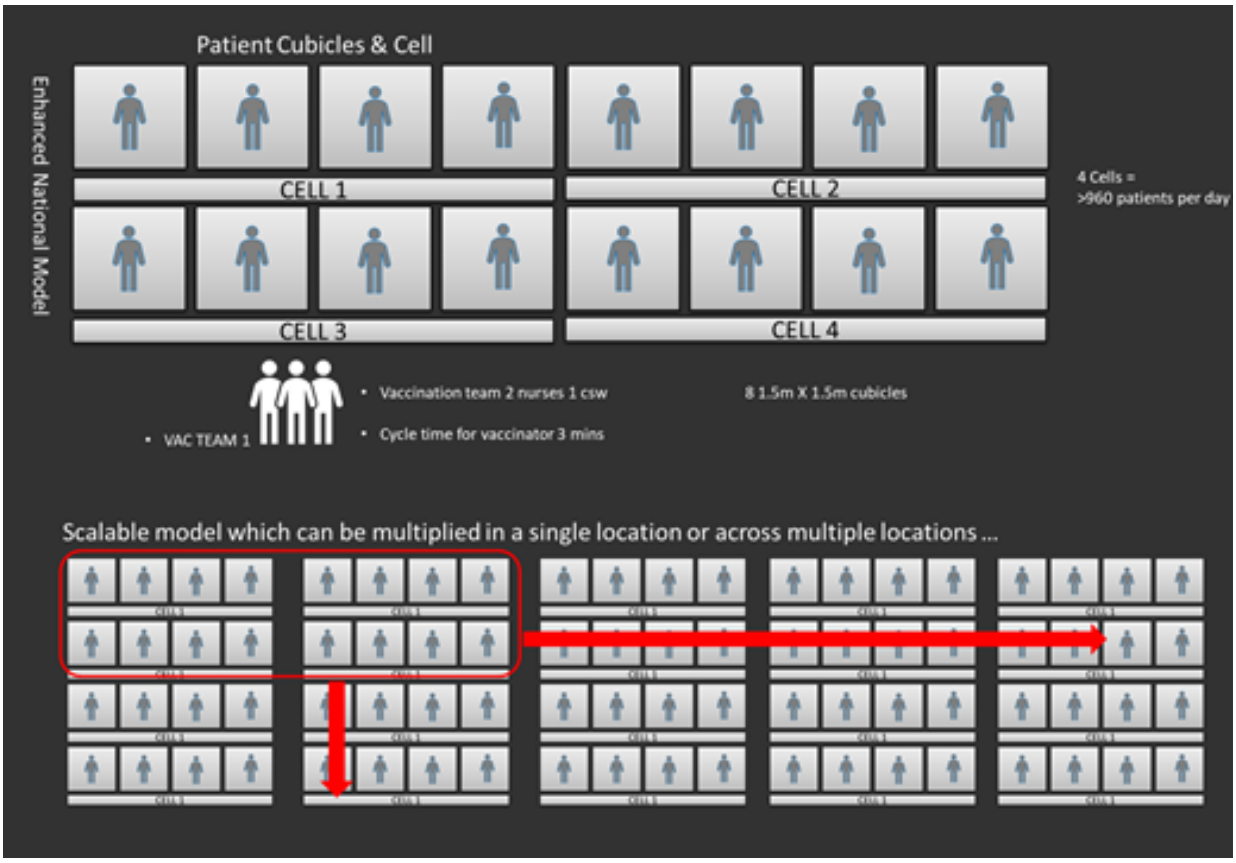
Staff (Assumes PSD Model)	Existing Model	Rapid-Vac Model
Front of House	2	2
Stewards (FOC)	4	6
St Johns Ambulance	2	2
Registered HCP (B5) Pre Screening	3	1
Registered HCP (B5) Vaccine Draw up	0	1
Registered HCP (B6)	1	1
Vaccinator	2	4
Healthcare Assistant	1	5
Prescriber	2	2
Pharmacist (not in model but req by Pfizer)	1	1
Total	18	25
Vaccination Capacity	320	960
Vaccinations per member of staff	**17.8**	**38.4**
***7 more staff but 4 less B5 Nurses**		

Rapid-Vac vs Standard Model

Staff (Assumes PSD Model)	Existing Model	Rapid-Vac Model
Front of House	2	2
Stewards (FOC)	5	6
St Johns Ambulance	2	2
Registered HCP (B5) Pre Screening	5	1
Registered HCP (B5) Vaccine Draw up	0	1
Registered HCP (B6)	1	1
Vaccinator	2	4
Healthcare Assistant	1	5
Prescriber	2	2
Pharmacist (not in model but req by Pfizer)	1	1
Total	21	25
Vaccination Capacity	320	960
Vaccinations per member of staff	**15.2**	**38.4**
***5 more staff but 4 less B5 Nurses**		

The model is scalable and modular to account for patient populations, resources and the local demand across the UK and NHS centres, whether that be a village hall, community setting, acute hospital or mass centre in a stadium or larger setting.

Example of layouts and scalability:



A four-cell model will output a daily capacity of 960 patients. The model is then scalable to achieve a greater number of patients with more cells added. The staffing numbers will increase, but not linearly. The exact staffing model depends on location, geography and the availability of vaccines.
As described above, the model is simple and scalable.

There are several ways to increase capacity to speed up the roll-out. These include considering:

- Additional cells and staff
- Additional hours or a second shift (day and late, day and night, 7 days per week, 24/7)

The above are dependent on getting enough trained and qualified staff to inject patients and enough vaccines to the location(s) set up to vaccinate.

PLANNING, REPORTING AND PATIENT MANAGEMENT

The planning of patients, as with any part of the NHS, is critical to ensuring centres are full of entitled patients. In order to manage the demand to ensure the capacity is fully used on a day-to-day basis, planning of the patients and re-planning where capacity does not meet demand is critical.

We have included an advanced planning tool and processes to support this:

DATA

Populated at PCN level it provides commissioners with a view of the adequacy of primary care delivery which can then be rolled up to CCG and/or STP level to determine Mass vaccination Centre Capacity requirements and implementation timeline.

RESPONSIVE

Already in use with STPs and commissioners, the tool can also track actual versus plan to enhance responsiveness to change.

REAL TIME

Changes to planning assumptions are immediately reflected in the schedule so the impact on demand, capacity and timelines can be understood and the plan adjusted in real time.

This also allows iterative planning and what-if scenarios.

OVERVIEW

A CCG/STP level dashboard provides multi-level system-wide oversight supporting programme risk assurance objectives.

We have also included a real-time reporting tool to track patients, performance and capacity which can be evaluated at different levels from Centre to CCG.

CASE STUDY

A WAY TO ACCELERATE MASS VACCINATION ACROSS THE UK

Walsall Hospital Trust

Unlike many of these models, which tend to be theoretical, we have put the model to work in the NHS in Walsall in three locations. These centres are now vaccinating in excess of 2,000 patients per day at double the vaccinations / staff member that the national model describes.

Designed a modular vaccination model which has 84% more capacity than the national model
Implemented a hospital hub in 2 weeks
Established 2 more mass vaccination centres (960/day) within 2 weeks
Increased vaccinations per staff member from 15.2 to 38.4 vs national model
Within 1 month the hospital hub had vaccinated 13093 patients
Reduced staffing model within the vaccination model by 3 band 5 nurses replacing with CSW/Admin roles
20 theatre staff actively took part in patient flow mapping events to identify improvement areas and develop solutions
Secured sufficient space and resource to create capacity to vaccinate the whole LA adult population in under 5 weeks

SUMMARY

There has never been a greater need to develop and create a scalable model for mass vaccination to reduce the time to get the majority of the population protected in our fight to overcome this terrible virus and restore some kind of normal for humanity.

By taking understood and well-known tools from industry and applying them to the model created, we can see gains of over 300% in terms of patients and increase the rate by hour in which we can vaccinate and treat patients.

Our ability to scale up will not be down to space, vaccine production, volunteers or effort. It will be restricted by the number of qualified staff that can inject the vaccine. This model and concept is easy to understand and apply whether you are considering a large national mass centre or a GP surgery or small parish hall. The modular nature makes it easily scalable and repeatable to increase capacity to vastly higher than current forecasts and projections of adults being seen in the UK by Autumn or late 2021!

So by simplifying, increasing capacity and reducing clinical staffing needs, why couldn't we get the whole population immunised and in weeks, not months or years?

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